Electronics in South Asia

Extended Version of the Industry Case Study Done for:

South Asia's Turn

Policies to Boost Competitiveness and Create the Next Export Powerhouse

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Executive Summary

The electronics sector has played an important role in the development trajectories of several newly industrialized economies. Surprisingly, South Asia is not currently a significant player in the sector, though electronics presents a substantial opportunity for the region. Addressing the constraints that have prevented the growth of this sector could help South Asia raise growth and create good manufacturing jobs.

South Asia's lack of competitiveness reflects inadequate provision of public goods rather than high labor costs. In fact, low labor costs remain the region's primary source of competitiveness, as the best firms combine lower wages than in East Asia with comparable labor productivity performance due to investments in good management systems and worker skills. Instead, many of the problems relate to policy, regulatory and infrastructural weaknesses that raise trading costs and increase lead times. Such constraints are extremely serious in an industry that is based on global networks. A particular issue in India concerns lower tariffs on finished goods than on necessary inputs, which discourages local production in selected products. In Bangladesh, a key constraint is the limited supply of large tracts of well-located and readily-available industrial land for large investors. In general, greater investment in R&D and in training workers could significantly increase productivity and returns in the South Asian electronics sector. The renewed interest of global electronics investors in the region – in India and Bangladesh in particular – shows that a few critical measures to address these constraints could help put the region on the global electronics map.

The analysis focuses primarily on India and Sri Lanka – the two countries which already have a critical mass of companies in the electronics sector – and touches on Bangladesh and Pakistan. In an effort to keep the analysis focused, the study looks only at two of the largest sub-sectors: telecommunications and consumer electronics. The study combines data from secondary sources on the drivers of competitiveness with in-depth stakeholder interviews. It has been suggested by some experts that while the "high-volume, low-cost" manufacturing that characterizes these sub-sectors remains important, for South Asia as a latecomer, new opportunities may be opening up for "low volume, high value strategies." [2]

This case study identifies both reasons for success and limits on the growth of electronics in South Asia, and recommends policies to enhance its growth. The next section discusses potential benefits of the electronics sector in South Asia, followed by an analysis of sector performance. We then turn to a discussion of the drivers of competitiveness in the electronic sector and the major constraints on performance. The concluding section summarizes policy recommendations to unblock the barriers to investment in this industry and fast-track its growth.

[2] Ernst (2014)

1. Motivation

The electronics sector is one of the world's largest industrial sectors and has made a substantial contribution to global growth. Global trade in electronic products, including communications and information communication technology (ICT) equipment and electronics-based consumer products, was estimated at $1.4 trillion in 2012, having grown 5.9 percent a year between 2008 and 2012.[3] From 1980 to 2000, the sector contributed from 0.2 to 0.5 percentage points to annual economic growth in nine OECD countries (between 0.3 to 0.9 percentage points if one considers just the 90s).[4] The sector's contribution to economic growth might have been even higher in developing countries, which benefited from access to more advanced technology in the developed world. The sector is an important driver of innovation and productivity, a source for the accumulation of technological capabilities and a catalyst for trade and investment. For example, the electronics industry – as the biggest sector in terms of output and exports – drove rapid industrialization in Singapore and Taiwan from the mid-1970s to 1990s.[5] Electronics are a major driver of innovation: 29% of all R&D investments in one thousand firms surveyed by Bozz & Company were devoted to electronics.[6] The share of electronics in R&D investment is even higher in some specific sectors, especially automotive (see the separate case study).[7] Moreover, electronics production is an important source of employment. The ILO estimates that the sector employed 18 million people worldwide in 2010.[8]

The sector presents growth opportunities for developing countries. An important feature of the sector is that production is highly fragmented, with value often added in a variety of countries before goods and services make their way to end consumers.[9] The ability to shift parts of the value chains to low-cost locations has created opportunities for developing countries to participate. Electronics companies from the developed world first started relocating to Malaysia, Singapore, Taiwan and Thailand during the 1970s and early 1980s, followed by China, Indonesia and the Philippines, primarily to take advantage of lower labor costs. In recent years, Vietnam has become an important producer for similar reasons. In 2013, information technology and electronics accounted for 7% of Vietnam's exports. This shift has allowed developing countries to increase their contribution to global value added in the electronics sector from 11% in 2000 to 30% in 2010.[10] Asia has been a major beneficiary and has become an important manufacturing hub, mainly due to its low labor costs, established supply base and proximity to key final markets.[11]

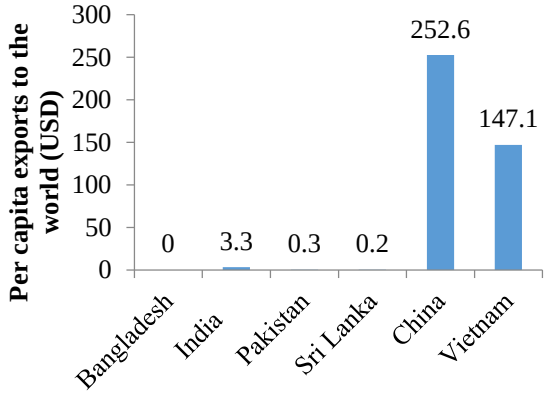
***Networks of international electronics firms are already in place in South Asia*.** Several multinational electronics firms (Samsung, HP, IBM, Motorola, Lenovo, Flextronics and Foxconn) are present, or have announced plans to invest in the region, and many large firms have

[3] Staff calculations based on UN COMTRADE data. The classification of electronic products is from Sturgeon and Memedovic ([not in references]).
[4] Collechia and Schreyer (2001).
[5] Poh-Kam (1995).
[6] Bozz & Company (2008) apud Bampi (2009)
[7] Oliver Wyman (2007) apud Lima (2012)
[8] ILO, 2014 (A)
[9] See for example Fernandez-Stark et al, 2011;Sturgeon and Kawakami et al, 2011
[10] J Manyika et al, 2012.
[11] ILO, 2014 (B).

set up R&D centers with world class capabilities in South Asian countries to support global operations. This activity has been encouraged by South Asia's large, fast-growing markets (for example, the electronics market in India is expected to grow at 24% p.a. to reach a market size of $400 billion by 2020)[2] and the potential of the South Asian diaspora with deep knowledge and extensive networks in the global electronics industry.

However, South Asia could have benefited more from the global shift of electronics manufacturing. Other countries that started from a much weaker position have forged ahead and established themselves as new global players in electronics manufacturing exports. For example, electronics exports in South Asia are small compared to that in East Asian countries (figure 1). India is only the 14th largest electronics producer globally, behind countries such as Mexico (8th), Brazil (10th) and Thailand (12th).

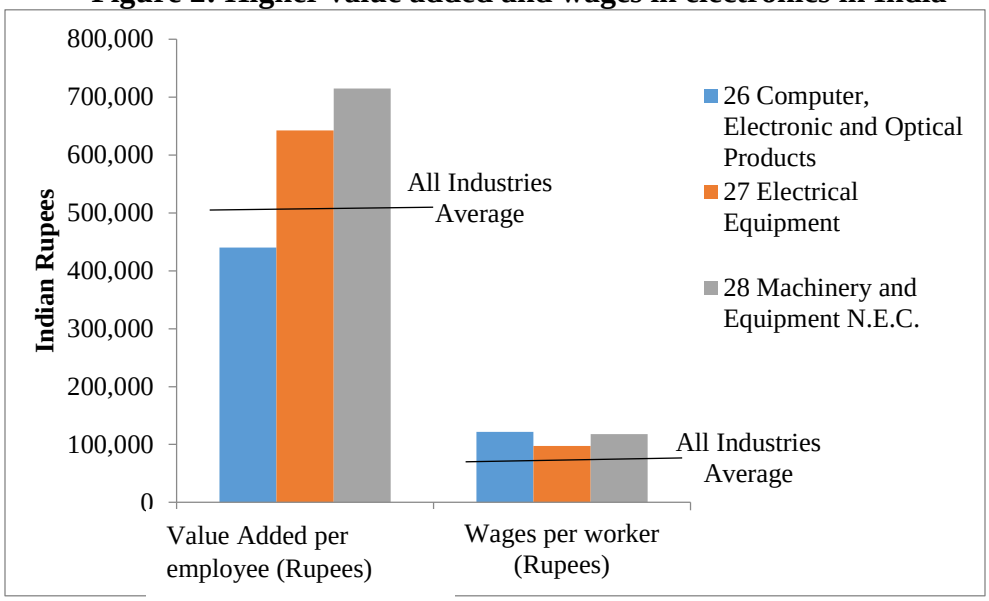
Figure 1: Electronics production is low in South Asia



Source: UN COMTRADE; Staff estimates based on WBG Enterprise Surveys

Electronic manufacturing could help South Asia create more and higher value added manufacturing jobs. The sector is included in the list of Governments' priority manufacturing sectors in virtually all countries of South Asia, for its potential to generate growth, exports and good jobs for workers (especially women) with basic academic and technical knowledge. In India, productivity and wages in the electronics industry are higher than the average for all industry (see Figure 2 below). Not surprisingly, electronics are an important part of the Government's "Make in India" and "Digital India" campaigns. In Sri Lanka and Pakistan too, the sector is being promoted on a priority basis.

Figure 2: Higher value added and wages in electronics in India



Source: Annual Survey of Industries, 2009-10, India

2. Performance Analysis

This section considers South Asia's performance in terms of output and trade, productivity and cost, as well as other key dimensions of competitiveness in this industry such as processing times and innovation.

Output and trade

South Asia has achieved only limited progress in increasing exports of electronics products. The region's share of global exports of electronics products remains very low (table []). And the share of electronics in South Asia's exports has increased little since the start of the new millennium (figure 3). The limited performance of South Asia's electronics sector is best viewed by an analysis of the experience in India and Sri Lanka.

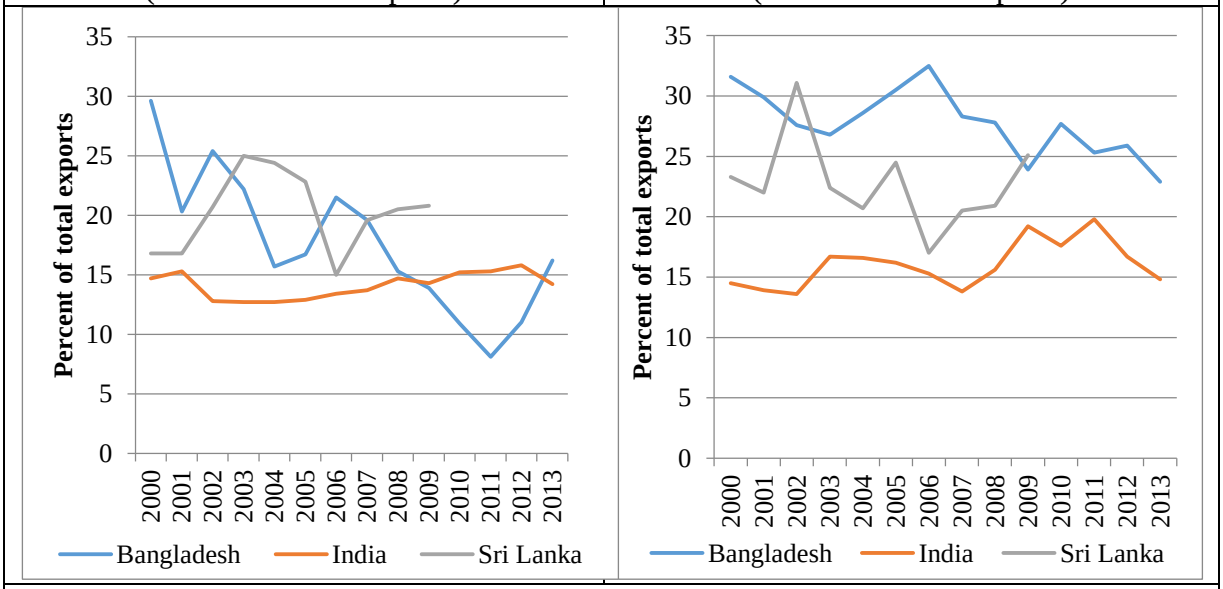
Table 1: South Asia's share of global electronics markets is low

World Market Share (%)		2004	2014
Bangladesh	Electronics	0.002	0.003*
India	Electronics	0.153	0.347
Sri Lanka	Electronics	0.011	0.009
Pakistan	Electronics	0.012	0.012

*2011, last year for which the data is available

Figure 3: Electronics Exports from South Asian Countries is Low and Stagnating

Final Electronics Exports (Percent of total exports)	Intermediate Electronics Exports (Percent of total exports)



Source: Staff calculations based on UN COMTRADE statistics

Electronics manufacturing in India was initially controlled by Government. The Indian electronics industry dates back to the 1960s. While the focus initially was on space and defense technologies, over time this gradually shifted towards consumer electronics – radios, black and white TVs, and other audio products. Color TVs started being produced in the 1980s. Till the 1980s, state-owned enterprises like Bharat Electronics Limited (BEL) and the Electronic Corporation of India Ltd (ECIL) dominated the sector, while the entry and operations of private players in the sector was controlled by the Department of Electronics.[12] The mid 1980s and early 1990s saw sustained and rapid growth in the sector. Many large international brands began partnering with Indian firms to enter the market.

Barriers to private sector electronics production were lowered as part of India's market liberalization program. Licensing requirements for consumer electronics were abolished in 1996. In addition, tariff and non-tariff barriers were slashed as India opened its economy to the outside world. India signed the Information Technology Agreement (ITA), in which participating countries agreed to bind and then eliminate all customs and other duties and charges on identified information technology products by the year 2000. India eliminated tariffs on 38 per cent of the ITA products by 2000 and the rest by 2005. Trade agreements with Singapore, Thailand, Malaysia, the ASEAN, Korea and Japan also reduced import tariffs. [13] Imports of electronics increased rapidly, and the number of domestic firms in the sector fell (Annex 1).

Indian electronics manufacturing has been struggling in the domestic market. In 2011, domestic production met only 36% of India's consumption of electronics products, and 49% for

[12] Any changes in product line or increased output for a product already approved required permission from DOE
[13] Hoda and Rai (2014)

electronic components, with the rest being met through imports. If present trends continue, this share is likely to come down further.[14] Indian manufacturers are losing ground even in areas where they were historically important. For example, according to the Indian Printed Circuit Board Association, currently roughly two thirds of the domestic market is being served through imports, while India's share of global printed circuit board (PCB) output is only 0.7 percent.[15] International firms such as Panasonic, Sony, LG, Samsung have taken a substantial share of consumer electronics, the largest segment of India's electronics market, which is now dominated by imports from China. Even bulky items like air conditioners ($1.6 billion market), refrigerators ($400 million) and washing machines ($158 million) are imported fully assembled into India, not to mention smaller goods like mobile phones ($1.9 billion)[16].

However, Indian manufacturing is showing signs of increasing market share in some areas. Indian exports of components and products have grown rapidly in areas such as mobile telephones, audio players and sound equipment, and display technologies. In consumer electronics and mobile telephony, international brands like LG and Samsung have established significant manufacturing facilities, and Indian companies like Micromaxx are increasing their presence. There is also a developing eco-system to support faster growth. More than 50 electronic manufacturing services/original design manufacturers operate in India, including global players like Flextronics and Solectron, as well as Indian firms such as Deltron, TVS Electronics and Sahasra. Some international players, notably Foxconn, have recently announced their decision to enter India (**Error! Reference source not found.**).

Box 1: Foxconn enters India

Foxconn, the world's largest contract electronics manufacturer, has signed a $5 billion deal to set up R&D and hi-tech manufacturing facilities in western India within the next five years. The $5 billion pledge is the largest foreign investment into India's tech manufacturing sector and a boost for the government's "Make in India" program designed to spur domestic manufacturing. The Taiwan-based firm, which manufactures for a host of global device brands like Apple, BlackBerry, Amazon, Motorola, Xiaomi and Sony, has the bulk of its factories in China.

Separately, leading Chinese smartphone maker Xiaomi announced that it will now manufacture its devices in India in partnership with Foxconn. The factory will be based in the southern state of Andhra Pradesh.

Going by the recent spate of announcements, Foxconn is becoming one of the most aggressive foreign investors in India. Last month, the company announced that it would inject $20 billion into India's solar sector along with Japan's SoftBank and India's own telecom firm, Bharti. Reports suggested that another Foxconn joint venture with billionaire Gautam Adani's Adani Group could focus on making iPhones and iPads.

[14] Ernst (2014)
[15] Indian PCB association (2008)
[16] Figures in brackets are imports in 2012/13

Also, Foxconn is rumored to have allocated billions of dollars for India's e-commerce and technology startups, and is said to be close to finalizing a $500 million investment into online retailer, Snapdeal.

Setting up manufacturing centers in India could be Foxconn's attempt to build an alternative to its manufacturing base in China, where market growth is slowing and wages are rising. Foxconn said it intends to set up 10-12 plants and employ a million workers in India by 2020.

Source: Forbes Asia (http://www.forbes.com/sites/saritharai/2015/08/10/foxconn-could-make-india-its-next-manufacturing-base-after-china-investments-suggest/)

Manufacturing is clustering around a few locations. The electronics industry in India initially grew around three major centers, Bangalore, Mumbai/Pune and Delhi/National Capital Region (NCR). Bangalore emerged as a hub early on, with major public sector plants in defense and telecommunication being located there. In recent times, Bangalore also has attracted private sector firms in computer and industrial products. Bombay/Pune and the NCR have become major manufacturing centers, and have emerged as favored destinations for MNCs. The NCR region, in particular, has a large concentration of small scale factories making consumer electronic products and computers. More recently, Hyderabad and Chennai have become important manufacturing locations.

Electronics manufacturing in India is largely small scale and oriented to serving the domestic market. A field survey of the manufacturing units and industry associations at different regions of the country in 2008 showed that 84% of firms were in the small scale sector. While the electronics component sector was largely in the formal sector, communication equipment and computer peripherals were largely in the informal sector. Fully 95% of local manufacturers did not have any foreign direct investment. The involvement of these firms in international trade was also moderate - 41% are engaged in exports.[17] It is unlikely that this picture has changed significantly since the survey was taken.

Sri Lanka's electronics industry is small. The electronics industry in the country started with manufacturing vacuum tubes and radios. Manufacturing now is concentrated around electronic components, which includes printed circuits, electronic circuits, transistors, valves, cathode tubes, refrigerators and freezers, lamp holders, telephone sets, and audi/video equipment and parts. The industry currently contributes about 2% of the country's export revenues and absorbs over 15,750 workers.[18] The apparel industry, in comparison, employs more than 8 times that number. The workforce is drawn from a pool of skilled young men and women with basic academic and technical knowledge.

Sri Lanka's electronics industry is also stagnating (Figure 2). The major decline has taken place in the telephone equipment segment, where exports fell by more than 80% between 2008 and 2013. India remains a major destination for electronic exports from Sri Lanka, particularly

[17] National Productivity Council
[18] Presentation on electrical and electronics sector, export services division, Sri Lanka (2015)

for primary goods (insulated wire). The EU, the United States and Japan are also important export destinations. However, Sri Lanka's preferential access to Indian markets under the Indo-Sri Lanka Free Trade Agreement has eroded, as MFN tariffs in India have fallen and India has entered into trade agreements with other countries (see Box 2).

Box 2: Preference Erosion in the India Sri Lanka Free Trade Agreement

The India – Sri Lanka Free Trade Agreement (ISFTA) was signed in December 1998 and became operational in March 2000. The agreement covered all items except those deemed sensitive by each country. India committed to an immediate elimination of 1,351 tariff lines, and a gradual phase out for a further 2,797 items. The duty concessions under the ISFTA conferred considerable benefits to Sri Lanka compared to MFN tariffs.

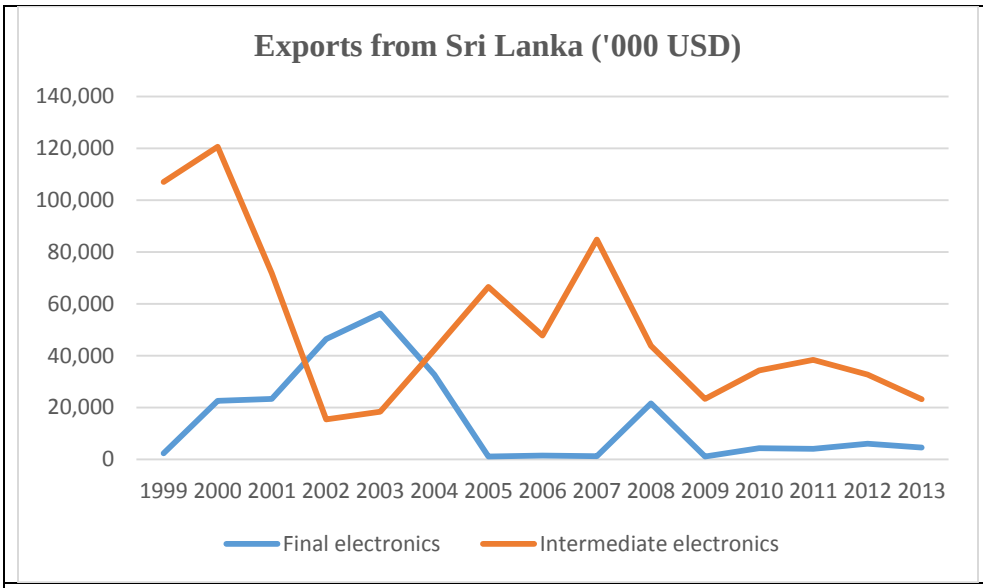
The immediate effects of the FTA were very positive for Sri Lanka. Its exports to India surged from US$58 million in 2000 to US$566 million by 2005. The composition of exports also shifted from primary products towards processed goods such as copper products, vegetable oils, pharmaceuticals, and white goods such as air conditioners and refrigerators. However, particularly in the case of copper products and vegetable oils that witnessed the largest increase, exports appeared to be driven by tariff arbitrage by Indian investors seeking to get around the India's high MFN tariff rates.

The benefits of tariff arbitrage began to decline after 2006, as trade liberalization in India led to a gradual erosion of the preference conferred on Sri Lankan exporters. In the electronics sector, the gradual implementation of the ITA-1 completed in 2005 saw tariffs coming down for identified information technology products to zero. India also entered into trade agreements with a number of ASEAN countries, most importantly with Thailand. Under the "early harvest" provision of this FTA, duties on a range of electronic goods were eliminated in September 2006. Electronics had not been a traditional export item from Sri Lanka to India. Thus, even while electronic exports to India saw a small increase in the early years of the ISFTA, the quick erosion of preferences relative to a very competitive Thailand - before buyer relationships, markets and supply chains could be fully developed - meant that the increase could not be sustained.

Both Sri Lankan and foreign firms are active in the sector. An estimated 70 electric and electronic component manufacturing factories are operating across Sri Lanka. Nearly a quarter of these employ less than 20 workers, but an equal number employ 300 workers or more. Some are Sri Lankan owned companies, such as IE Electronics which manufactures electricity meters and transmission equipment. Others, like Tos Lanka and Nippon Marudhi Lanka, are foreign-owned. The most recent entry to the Sri Lankan market is Okaya Denk a major global player in electronics that specializes in manufacturing of noise suppressors. Lanka Harness manufactures a range of automotive harnessing and electronics for Toyota in Japan. The sector is moving towards the higher quality end of the spectrum. The industry is attracting sophisticated buyers

from electronics manufacturing services partners operating in Japan, Europe, North America and India.

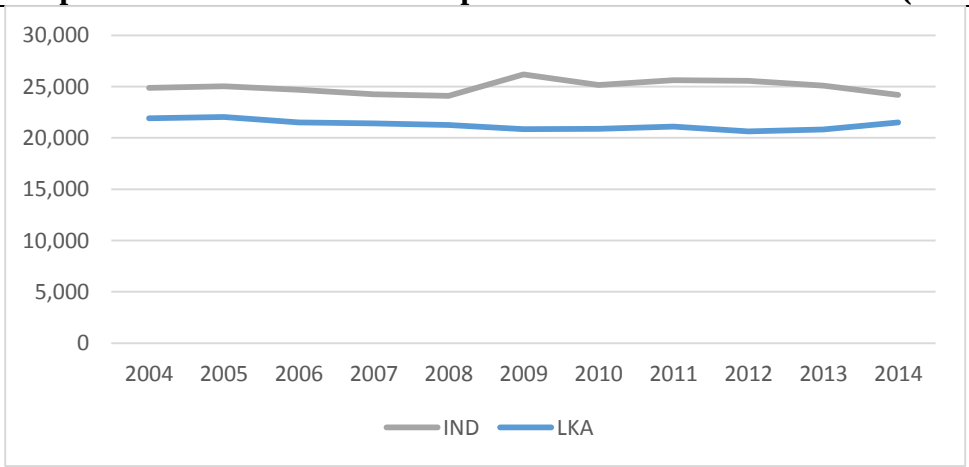
Figure 2: Electronics exports from Sri Lanka have fallen since 1999



Source: WITS, Staff Estimates

The quality of Indian and Sri Lankan exports remains unchanged. A measure of sophistication (PRODY)[19] indicates that the quality of Indian and Sri Lankan exports has remained practically constant over time (figure 4). The failure to improve quality may be an important explanation for the stagnation in electronics exports.

Figure 4: Sophistication of Electronics Exports from India and Sri Lanka (PRODY)



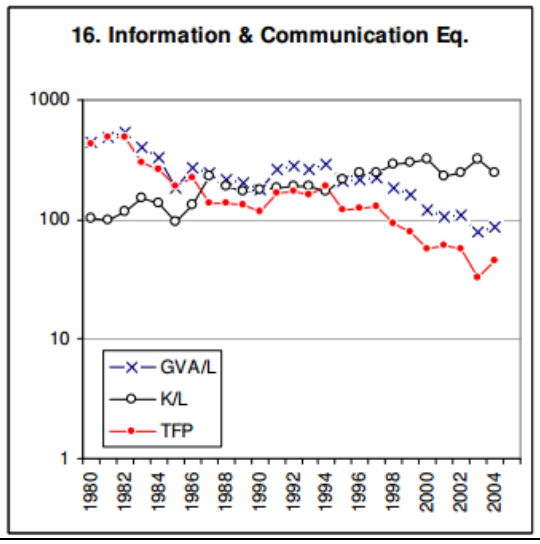
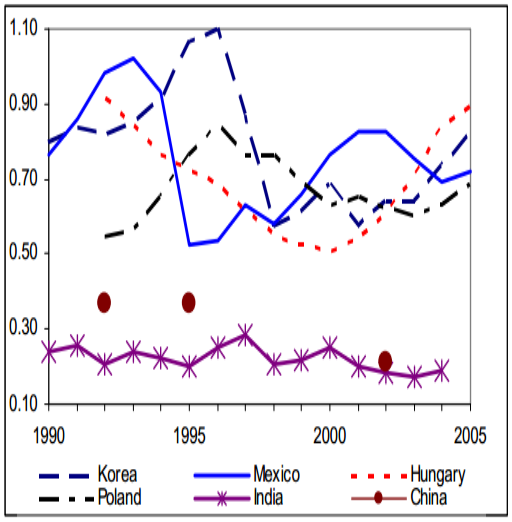
[19] PRODY is a weighted average of the per capita GDP of countries producing electronics goods, with weights derived from Revealed Comparative Advantage.

Source: Staff calculations based on UN COMTRADE statistics

Productivity and cost

The lack of competitiveness of South Asian electronics manufacturing after the early 2000s was apparently not due to low labor productivity or high costs. Labor productivity and total factor productivity (TFP) growth in information and communication equipment was higher in India than in China through the 1990s (Wu et al. 2007). However, growth came down steadily, and by the mid-2000s, India had lost much of its initial advantage (**Error! Reference source not found.**4, left panel).[20] Similar evidence comes from Ark et al (2008), who find that India had higher labor productivity and lower labor costs than China through much of the 1990s. China however saw rapid increases in labor productivity that took it to a level above that of India by the mid-2000s. Nevertheless, higher compensation levels meant that unit labor costs Chinese manufacturing were slightly higher than in India (**Error! Reference source not found.**4, right panel). Leading firms in India estimate that productivity at their plants is comparable to Chinese levels. Samsung, in fact, mentioned that their Noida plant is among their three most productive units worldwide. Similarly, enterprise surveys show that productivity in Sri Lanka is high. Sri Lanka has a higher value added per worker in the electronics sector than China (USD 24,701 vs. USD 22, 382—figure 4, left panel).

Figure 4: Labor Productivity in India's Electronics relative to comparators

India/China Comparative (China=100)	Unit labor Costs
	
Source: Wu et al (2007)	Source: Ark et al (2008)

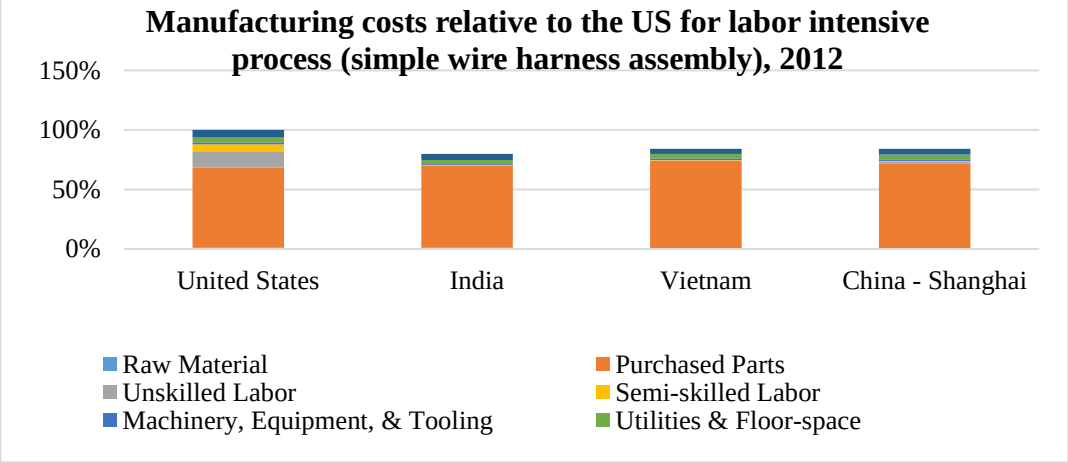
GVA/L = Gross Value added per worker, K/L= Capital to Labor ratio, TFP=Total Factor Productivity

The main cost disadvantages derive from factors outside the factory. Cost comparisons, obtained from a global manufacturer with facilities around the world, shows that manufacturing costs in India are 80% of those in the United States, and importantly, slightly lower than in China and Vietnam (Figure 5). In large part India's cost advantage derives from its low labor costs. However, "Selling, General and Administration (SGA)" costs, which reflect costs outside the

[20] Xu et al. (2008)`

factory, are relatively high.[21] The largest driver of costs is the cost of purchased parts. Any tax, policy, regulation or inefficiency that raises the cost of purchased inputs (including trade logistics and trade policy as discussed later) could have a large impact on the sector's competitiveness.

Figure 5: India has a cost advantage in labor intensive processes



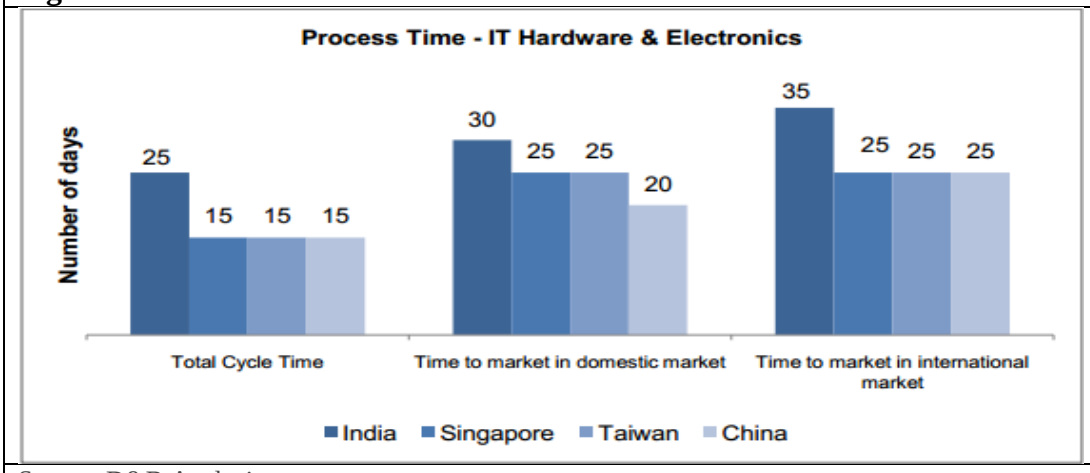
NB: Data is from auto parts manufacturer but is representative of costs in electronics sector

Processing times put South Asia at a disadvantage. The ability to rapidly start and scale up production of new products and deliver these to the market can sometimes be a more important consideration for firms than the cost of production. Countries that are able to achieve faster turnaround time gain significant competitive advantage, especially in the more innovative, cutting edge products. This is where South Asia may be at a disadvantage. Processing time is higher in India than in other big electronic manufacturers like China, Singapore & Taiwan (figure 6).

As will be developed later, one reason for this are delays in procuring imported raw materials and components that lead to delays in production. Further, delivery time from ports to factories, and then from factories to final destinations, adds to the overall time required to bring products to market.

[21] SGA is the sum of all direct and indirect selling expenses, which includes salaries (excluding those related to the production itself), advertising expenses, rent, and all expenses and taxes related to selling the product.

Figure 6: Process times for IT Hardware and Electronics



Source: D&B Analysis

South Asia also lags in innovation, which is another key success factor in this sector. Most electronic firms in South Asia report some spending on innovation: of 301 electronic firms included in the World Bank Enterprise Survey, 69% reported spending on innovation. However, innovation expenditures were low in a global context: only 1.1% of sales in large firms employing more than 100 workers, and 4.7% in small firms. The low level of expenditures on innovation is disappointing, given that the impact of innovation on productivity is large. An increase in the share of new products in firm's sales by 1% is associated with a productivity increase of 2.6%, which is extremely high (on average in other countries this elasticity is one tenth of this level).[22] The percentage of new products in firm's sales was 7.5% on average.

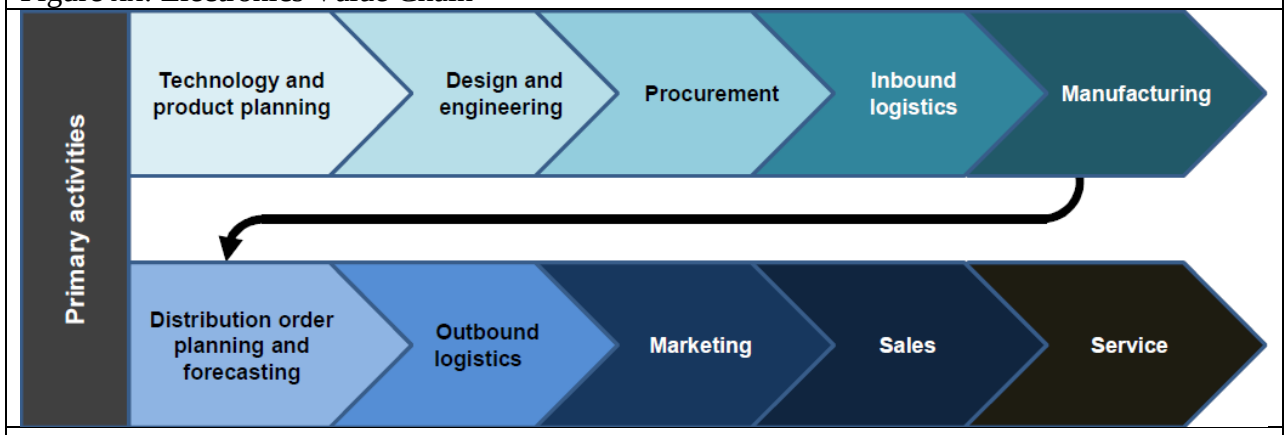
3. Drivers of Competitiveness

The global electronics industry is highly competitive, innovative and fast moving. Between 2004 and 2009 global GDP rose by 2.2% annually, but electronics production rose 4.9% per year.[23] Rapid growth was accompanied by rapid change in the main market players. For instance, IBM was the largest firm in this industry in 2005, but dropped to 5th in 2015. During the same period, Samsung Electronics started as the 5th largest but ended as the first. Apple was not ranked in the top ten in 2005 but is currently the second largest.[24] Rapid growth presents a number of challenges for all stakeholders, who face constant pressure to keep up with new developments. Companies need to be innovative and flexible, and government policies need to support this. In the absence of success in innovation, companies, regions, and countries can find themselves confined to low value added activities within the highly fragmented global value chains (GVCs) that dominate the sector. Policy should support movement towards higher value added niches within GVCs, rather than simply encouraging

[22] Hall and Mohnen, 2013 estimate this elasticity at around 0.25 based on a survey of literature. However, most of the outcomes in this survey are based on papers from developed countries. Investigating it for developing countries, Crespi and Zuniga (2012) results suggest an elasticity ranging from 0.24 to 1.92.
[23] World economic growth is from WBDI and electronics production growth is from Lima (2012).
[24] Ranking Global 500 – Fortune CNN.

participation in the sector.[25] Finally, globally, the industry is very lean. Excess inventory or transit time anywhere in the value chain can result in value loss, which can be a severe disadvantage in such a fiercely competitive industry. Thus, cost and speed - in production and logistics- are both important determinants of competitiveness. The following discussion of the strategies of successful South Asian firms in the electronics sector is based on detailed interviews conducted with large lead and contract manufacturing firms.

Figure xx: Electronics Value Chain



Source: Korea Associates Business Consultancy Ltd (2012)

FDI has played an important role in firms' success. Some of the most successful firms in India and Sri Lanka are foreign, with investors bringing in technology, capital and foreign market linkages. For example, Samsung entered India in the early 1990s when the sector was just opening up, through a joint venture with Videocon (an Indian white goods manufacturer). Initially the company produced TVs and computer monitors. This approach helped it overcome many uncertainties associated with entering a new market, and allowed it to benefit from Videocon's market presence. At the same time, Videocon benefited from Samsung's technology and capital. Similarly Tos Lanka (see box 2), one of the largest electronic assembly firms in Sri Lanka, is a wholly owned subsidiary of Toslec Co., based in Kyoto, Japan. Toslec Co. is one of the leading manufacturers and suppliers of electronic components to Matsushita Electronics, Hitachi Media, Richo Elemex, Nihon Densan, Japanese Storage Battery Co. Ltd., and Rohm Company, and brings with it these market connections. These examples highlight the important role of FDI in international production networks.[26]

Linking to large markets is important for growing the sector. The bulk of electronics manufacturing in India is sold domestically, and manufacturers point to growing domestic consumption as the main reason for investing in electronics manufacturing. International markets, however, are important in some segments. For example, a domestic producer of medical equipment emphasized the importance of global partnerships and international markets- *"For us the major reason for expanding manufacturing is to develop partnerships with global industry*

[25] Sturgeon (2015)
[26] See for e.g., World Bank 2005, UNCTAD 2013, Hoda and Rai (2014)

leaders."[27] In Sri Lanka, the domestic market is smaller and most successful firms have an export focus. While exports to India are not growing, the industry is focusing on attracting sophisticated buyers from Japan, Europe and North America.

Box 2: Tos Lanka Company (Pvt. Ltd.)

Tos Lanka is Sri Lanka's largest electronic assembling solution company. It commenced operations at the Biyagama EPZ in 1998, with an initial investment of Rs 220 million. Tos specializes in the Surface Mounted Technology (SMT) assembly of printed circuit boards, electronic guitar tuners and effectors, coils and electronic components for the automotive industry. The products are exported to Japan, the United States and the EU.

The factory has manual and automated electronic assembly lines, supported by chip mounting and wave soldering plants, together with extensive testing facilities. Female workers dominate the 240-strong workforce . The company has invested in training and development of staff to manufacture electronic products and components to international standards. Workers at Tos Lanka undergo training in Japan for a period between three months to a year. The majority of the work force has been trained in Japan under AOTS/JASTECA scholarships in quality-oriented manufacturing processes.

The company has also established its own Research and Development section, and looks forward to accessing the huge Indian market through the Comprehensive Economic Partnership Agreement (CEPA).

Appropriate choice of products, aligned with market conditions and sources of competitiveness, is critical. Most successful companies in India seek to compete as low-cost producers, predominantly for lower-end, more mature market segments. Some see potential in producing in segments that are declining globally, but where the large domestic market provides opportunities to concentrate global production (examples include CFL bulbs and feature phones). Presumably for these segments production costs, rather than speed, are the main driver of competitiveness, and Indian companies feel their productivity and costs compare well with China. Sri Lankan firms, on the other hand, are moving towards producing more sophisticated electronic manufacturing products and services that can be exported to the large, lucrative Western markets. The adoption of ISO certification, Restrictions of Hazardous Substances and Waste Electrical and Electronic Equipment regulations, and decent labor standards in conformity with ILO requirements have helped it compete in these markets.

In-house R&D capability is a driver of competitiveness. Successful firms report that investments in developing R&D capacity have enabled them to compete on quality as well as cost. This is consistent with the empirical finding that returns to innovation are high in South Asia. In particular, firms identified their ability to innovate and customize products to South Asian conditions (for example, unreliable power and water supply) as a big advantage vis-à-vis Vietnam. It is likely that the advantage conferred is more important for consumer white goods,

[27] Ernst (2014)

than for products which are bulk manufactured and require less customization, for example, mobile phones.

Clustering has helped get around infrastructural weaknesses. Firms in South Asia prefer their suppliers to locate in close proximity to their plant to facilitate quality control and reduce transport-related uncertainties in the supply chain. As a result, clusters of firms have emerged around plants, which is an important part of overall efficiency. In turn, companies support vendors through vendor development programs aimed at upgrading quality; and through providing product designs. For example, clusters of suppliers are emerging around Samsung's main plants in Noida and Chennai.

Private investments in labor skilling are necessary. Most firms in both countries feel that skill levels of workers need to be improved, and invest significantly in doing so. For example, Samsung runs an apprentice program, and up to a year may be required to bring workers up to speed. This is among the longest training times for their plants around the world. Similarly, workers at Tos Lanka undergo training in Japan for a period ranging from three months to one year (Box 2).

Successful firm may benefit from Government subsidies, but do not report them as critical. For example, Samsung benefited from tax breaks under Uttar Pradesh's "large plant" policy scheme, and both the Noida and Chennai plants originally received customs and excise tax benefits by being designated as Special Export Zones (SEZs). However, Samsung had its land re-designated as a Domestic Tariff Areas (DTA), at the cost of losing these benefits, as it was not ready to comply with performance standards set on SEZs. A majority of firms interviewed in Sri Lanka reported receiving no benefits or incentives from Government. It appears that investment decisions are based on fundamentals, and incentives are important only at the margin.

4. Constraints on Competitiveness

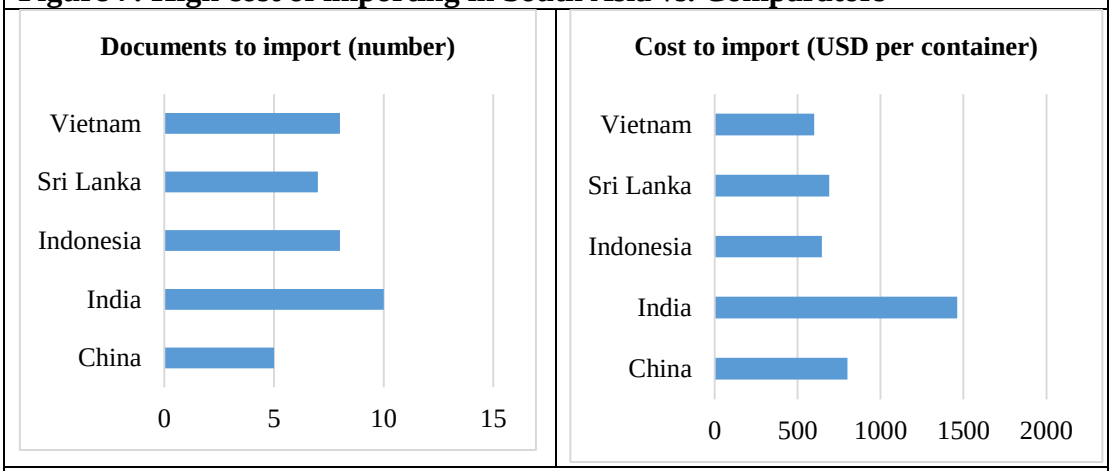
This section discusses the main constraints to improved productivity/export performance in South Asia. The previous section identified non-labor costs, processing time and low innovation as constraints that have prevented South Asia from integrating more into global electronic chains. This section examines some of the factors behind this.

Cross-cutting investment climate constraints do not show up as significant in enterprise surveys in the electronics sector. A regression analysis based on a survey of enterprises across Bangladesh, India, Pakistan and Sri Lanka (see Annex 6, table 3) reveals little correlation between cross- cutting investment climate issues (for example, corruption, political instability, tax rates) and productivity in the electronics sector. This accords well with the observation that the sector has done well even in countries where the overall environment may not have been as conducive as others (for example, Vietnam), so long as certain basic pre-requisites for the sector –ease of trading, logistics and flexibility- are taken care of.

Lengthy and unpredictable import clearance reduces the competitiveness of South Asian electronics production. South Asian firms are highly dependent on imports, and report that customs clearance can take considerable time and is unpredictable. Firms compensate by holding

higher inventories, which undermines cost competitiveness in this very lean industry. Inadequate customs services also delay production and increase turn-around times that, as noted earlier, can severely erode competitiveness. In India, the average time reported to clear customs varied from 2-10 days for large firms, and 14-21 days for SMEs. Lengthy clearance times in part reflect cumbersome and time-consuming procedures (e.g. due to conflicting interpretations and ambiguities in product classification) involved in obtaining exemptions to import tariffs on raw materials and parts & components by IT product manufacturers (exemption notification 25/99). Mechanisms to address grievances also can take considerable time, and companies fear reprisal, for example through losing their trusted trader credentials. One firm stated that *"The customs bureaucracy is very difficult to handle when we import various equipment and that creates a big disincentive for anyone venturing into this market."* Another interviewee said that: "*To gain one rupee in customs duties the country is losing thousands*." Sri Lanka performs better than other countries in South Asia on trade facilitation, but compares slightly unfavorably with its East Asian competitors. According to the Doing Business study 2016, it took 72 hours and cost $300 to import into Sri Lanka, compared to 64 hours and $268 in Vietnam, and 50 hours and $233 in Thailand.

Figure 7: High cost of importing in South Asia vs. Comparators

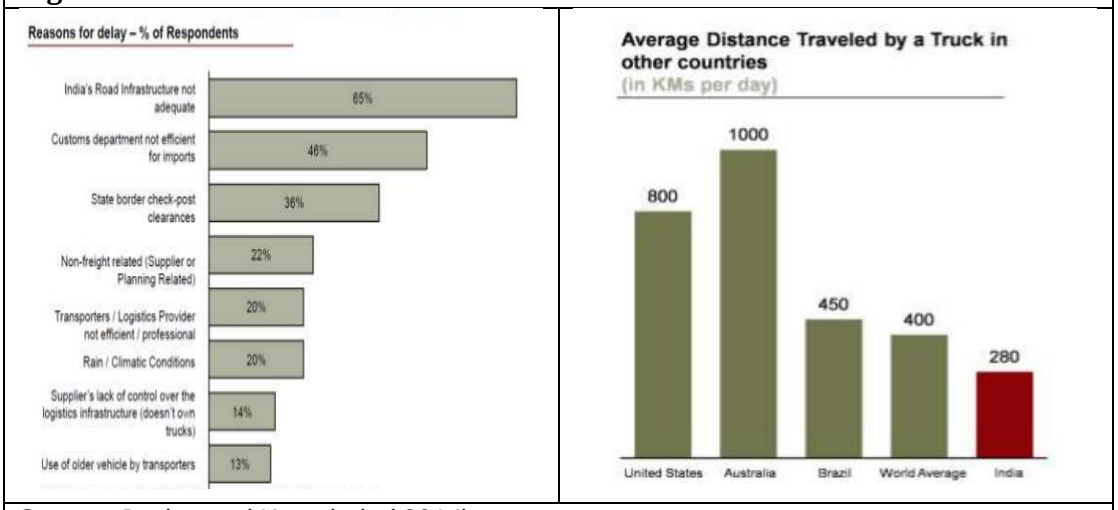


Source: Doing Business, 2015

Internal logistics are long and unpredictable, raising inventory costs. Fast and reliable logistics are extremely important for a lean industry like electronics. However, even after goods exit the port, poor internal logistics are affecting competitiveness. Indian firms reported that while it takes 11 days for a container to travel from Shanghai to Mumbai, it takes 20 days to travel from Mumbai to Delhi. Poor infrastructure is one reason, but a careful survey shows that a quarter of the journey time is spent at check posts, state borders, city entrances, and other regulatory stoppages (Figure 8, left panel). The existence of two state borders between origin and destination can add as much as a week to delivery schedules. Average distances covered are low, in part because documentation requirements for internal transit are burdensome, and barriers at the borders create opportunities for delay and rent-seeking (Figure 8, right panel). In order to deal with the resulting uncertainty, firms in four industries (auto components, textiles, electronics, and heavy engineering) report maintaining 27 percent higher inventories on average. Total logistics costs- including inventory costs and lost sales- account for 14 percent of total

costs for electronics firms, high by international standards.[28] Foxconn CEO Terry Gou commented on TV that "*Your (Indian) infrastructure will be a big limitation. Today I was told it will take 20 minutes to reach you, but it took 1 hour 20 minutes because it rained*."[29] Similarly in Sri Lanka, the rural infrastructure remains underdeveloped with neglected roads and rail lines which undermines rapid inland movement and hinders development of the electronics sector in areas where land may be cheaper and more readily available.[30]

Figure 8: Customs Clearance in India



Source: *Jordan and Kamphuis (2014)*

Inverted tariff structures in India are a constraint in selected products in India. Expenditures on parts is by far the largest contributor to costs in electronics manufacturing (figure 5), so duties levied on imported parts and components (P&C) can have a significant impact on domestic production costs of the final good. Lower duties on final goods than on parts will favor imports of final goods over domestic manufacturing that relies on imported P&C. This negative protectionism has been mentioned repeatedly by sector firms, and recently received attention in policy circles in India.[31] Four areas are of concern:

(i) The Information Technology Agreement-1 (ITA-1) provided exemptions on import duties for parts and components used in information technology products, except for "dual use" materials - those used in other industries (importantly copper, aluminum, glass and plastics). This problem has been recognized by the Government of India, and a notification (notification 25/99) provides duty exemption for dual use materials if the end use is for a product covered under the ITA. However, as discussed above, the procedures related to claiming this exemption are so cumbersome that companies are discouraged from taking advantage, which may lead to a preference for importing the final good.

(ii) Imports of medical equipment face a duty of 5 percent, while materials for their production face a tariff of 5–7.5 percent.

[28] World Bank (2014)
[29] http://www.hindustantimes.com/business-news/now-foxconn-looks-to-set-up-payments-bank/article1-1385877.aspx
[30] UN ESCAP 2011
[31] Subramanian and Modi, 2015

(iii) India's trade agreements with Singapore, Thailand, Malaysia, the ASEAN, Korea and Japan resulted in an inverted tariff structure for some products. However, the Government has addressed some of these, most recently in the Budget of 2014/15 (as in the case of LED TVs).

(iv) Finally, a special additional duty of 4% is imposed on inputs for important consumer products like refrigerators, air conditioners, and washing machines, while imports of the final products are exempted from duty (see Annex 2). As a result, big brands may prefer to import these finished goods from their affiliates in East and South East Asia, rather than manufacture them in India.[32] As one manufacturer explained, "*Import content on our products is close to 52%, and due to the higher duty structure on components, the overall disability is 30-40% on the final price of the product."*

Significant investment is required by firms to ensure an adequate supply of skilled workers. The availability of cheap and adaptable labor is one factor that makes South Asia attractive as a manufacturing destination. However, capitalizing on South Asia's advantage in workers requires significant investment in training and improving people's productivity. The returns can be large – international evidence shows that a 1% increase in training is associated with 0.6% increase in value added per hour.[33] The question is who makes this investment? In South Asia public investment on training has been low and of poor quality, comparing unfavorably with other competitor nations. For example, vocational education programs in India can accommodate only 5% of secondary school graduates, while China has the infrastructure to train half of all secondary school graduates. The quality of training is also an issue. Across the region, the development of new programs and curricula is difficult in public institutions. Quality is further hampered by the lack of industry participation in training.[34] In China, Government finances hiring and training programs, as well as employee housing, which Government sees as critical to acquiring sufficient manpower, enhancing productivity, and sustaining long-term competitiveness. Industrial parks have on-site, well-equipped technical and vocational colleges and secondary schools, with market-driven curriculum and management. Vietnam provides subsidized training for employees. Programs include soft skills, technical English, technical skills as well as on-demand training. Further, companies can set aside 10% of annual taxable income for R&D. This sharing of skilling costs between the state and private companies can significantly encourage investment, especially for companies with a long term vision.

Policy clarity and responsiveness in South Asia is lower than competitors. The fast moving nature of the electronics sector presents unique challenges for policy makers, who need to constantly stay abreast of developments and respond quickly to emerging challenges. The slow responsiveness of regulations that hampers firm agility was reported as one of the biggest constraints on sectoral growth in both India and Sri Lanka. A major challenge for any company that considers investing in electronics manufacturing is the multiple clearances needed for setting up a manufacturing facility. India ranked 155 out of 189 economies in terms of starting a business in Doing Business 2016. Sri Lanka ranked better (98), but it nevertheless cost 18.7% of income per capita to set up a firm, compared to 6.4% in Thailand and 4.9% in Vietnam. Firms

[32] Hoda and Rai (2014)
[33] Dearden, Reed, and Van Reenen, 2006
[34] BCG (2013)

also complain about the lack of coherence in the regulatory framework, excess paper work, and a multiplicity of laws, which are often unclear (for example see box 5). Complex and burdensome tax structures and regulations that impose substantial compliance costs affect all types of companies, but particularly affect SMEs and start-ups (according to firm surveys). Government policies, that in themselves were often quite good, were also impaired by weak implementation capacity. By contrast, other countries with large electronic manufacturing sectors often focus significant Government attention on easing the regulatory problems facing firms. Vietnam, for example, has a designated deputy PM dedicated to easing problems in the electronics sector. Finally, South Asian firms complained about poorly targeted incentives that do not counter specific locational disadvantages, are not aligned with what other competitors are offering, and too often are associated with complex procedures that reduce access (see Annex 3 for a comparison of incentives offered).

Box 3: The Medical Devices Sector in India

The Indian healthcare market has been growing by 15% per year and is set to reach $150 billion in size by 2017. Market spending on medical devices and equipment has grown faster, at an impressive rate of 17% per year in recent years, and constitutes 9% of the overall market size. The sector remains heavily dependent on imports, which accounted for 65% of sales in 2011. Multinationals have around a 65% share of the market and dominate the hi-tech equipment and devices. Many of these, for example GE, Siemens and Philips, have established subsidiaries in India. In addition, there are around 700 Indian manufacturers primarily focusing on low-margin, low-technology products like disposables and medical equipment. Two thirds of these are SMEs. Like most developing countries, India is also predominantly a manufacturer of Class I and II devices, i.e. devices that are not considered to be high risk and that do not need extensive clinical trials.

Increasingly, foreign medical device companies are outsourcing activities to India, as a way of reducing costs in manufacturing, R&D, clinical trials and other medical services. The activities being shifted include business operations for the South Asian region, contract manufacturing of components by Indian companies for global markets, developing software for advanced imaging equipment, R&D to customize products to South Asian conditions, and clinical research and trials. This presents an opportunity for India to increase domestic manufacturing and become a more important participant in global medical device value chains.

At the same time, a number of issues are hindering growth of the industry. Part of the issue derives from the demand side. Barriers that limit access of a large percentage of people in India to healthcare and medical technologies include lack of awareness, screening diagnosis, trained surgeons and affordable technologies. Further, the government spends only about 1 percent of GDP on health in a country where the majority of patients are from low income households.

The industry is also faced with significant lack of clarity in terms of regulation and predictable access to market. The regulatory framework in India applicable to medical devices is inadequate. The Indian government has regulated only a few types of medical devices. These are being regulated by deeming these medical devices as “drugs” and

regulating them through the Drugs and Cosmetics Act, 1940 ("Act") and the rules framed there under viz. Drugs and Cosmetics Rules, 1945 ("Rules"). All other types of medical devices are unregulated, meaning there is no government oversight on their manufacture, import, distribution and sale. The country lacks comprehensive legislation specifying standards of safety and quality for medical devices. The absence of this framework creates uncertainty in the operating environment, results in inferior quality products flooding the market and putting price pressures on genuine manufacturers, and hampers the standing of the Indian market.

Source: ValueOn Shore (2015)

Land is a constraint for large investors and clustering, especially in Bangladesh. Clustering of lead and supplier firms in close proximity is an important source of efficiency, and allows for greater quality control (Box 5 lists benefits of clustering for individual firms). However, clustering in South Asia is rendered difficult because buying land at suitable locations is often an arduous and expensive task. Verification of titles is complex and procedures for purchasing land take time. It is difficult for large companies to assemble enough small plots of land. The scarcity of adequate land is also reflected in very high prices. Companies prefer to locate close to major markets or ports, but some Indian and Sri Lankan peri-urban areas are among the most expensive in the world.[35] The practical solution to these issues has been industrial zones, which played a central role in the development of manufacturing, electronics in particular, in East Asia. The lack of readily-available and well-located industrial land is probably the main constraint on the development of the sector in Bangladesh. For example, in 2011 Samsung requested 250 acres in an EPZ to develop an electronics hub in Chittagong ($1.25 billion investment, 50,000 workers). The investment did not materialize because no more sizeable land was available in the BEPZA zones, and land in the mostly empty Korean Export Processing Zone is under dispute. By contrast, Vietnam has been able to provide large, readily-available tracts of land to large investors as well as their suplliers. One of these, Samsung was able to locate there along with 76 of its Korean suppliers, and now directly employs 100,000 workers .

Box 4: The Benefits of Clustering for Firms

- Reduced dependence on unreliable logistics for lead and supplier firms allowing for predictable supply and tighter inventories
- Anchor firms can maintain stronger quality control over suppliers
- Increased bargaining power with infrastructure providers can potentially improve access to essential infrastructure or help lower mitigation costs, for example through clusters negotiating a dedicated power distribution station
- Easier access to soft infrastructure such as mentoring and sharing of knowledge among entrepreneurs
- Improved access to and cost of finance thanks to the pooling and credibility effect of the cluster
- Lower skilling costs through provision of common training facilities

[35] Saleman and Jordan (2013)

5. Policy Recommendations

Cut tariffs all the way up the supply chain to remove the inverted tariff structure in India: There is a strong case for India to continue its trade liberalization and lower tariffs all along the supply chain. As noted earlier, the partial relief given through Notification 25/99 is difficult to implement, and such tariff reductions could help provide an impetus to domestic manufacturing.

In the interim, Government could take steps to reduce the administrative burden involved in obtaining exemptions (see box 6). Lowering tariffs could also benefit P&C manufacturers across South Asia, including in Sri Lanka and Bangladesh. For exports, the destination principle of indirect taxation incorporated in the WTO rules means that import duties and charges levied on the parts and components imported for use in the manufacture of finished goods that are later exported, are either exempted or refunded through drawback schemes when the actual exports take place. In order to make this easier, South Asian Governments may wish to consider provision of bonded warehouse facilities for firms exporting electronic goods.

Improve trade facilitation measures and infrastructure: There are a number of broader trade facilitation measures, including commitments made under the WTO Trade Facilitation Agreement that would speed up clearance processes at the border in South Asia. Key measures include fully electronic submission of documents, improved coordination of border management across responsible agencies, and establishment of an effective and quick grievance redress mechanism.

Box 5: Options for streamlining the implementation of Notification 25/99

1. Presently the application for obtaining the concessional rate of duty is to be submitted to the Assistant Commissioner or Deputy Commissioner of Central Excise through the Range Superintendent. This causes undue delay in clearing consignments, and a good number of cases involve demurrage.
   The application should be countersigned by the Range Superintendent instead of the Assistant Commissioner or Deputy Commissioner of Central Excise

2. The procedure involves executing a bond for the differential amount of duty, which has to be given individually against each consignment or a running bond for the total amount required for a year. The procedure for extinguishing this bond is also not clear and very cumbersome. Applications are made for each item, separately for each port of import, for requirement of three months.
   This is a tedious and repetitive procedure and it is recommended that yearly applications be permitted.

3. Intimation is required to be given to Central Excise within 24 hours of material receipt and the material cannot be used until it is verified.
   This restriction could be removed, allowing provision of monthly

information on the items received to be filed.

4. Central Excise Department verifies the records and input to output ratio, and issues the End Use Consumption certificate. This procedure takes a long time and serves no purpose, as most items covered under notification No.25/99 can be used only in the manufacture of the related end product. The end result is delay, stock out and stoppage of production.
   Se*lf-certification / Chartered engineer certification based on the input output ratio and /or norms for consumption of the raw materials should be accepted. It is also recommended that the firms' records may be accepted for issuing the consumption certificate and the format for this record and the input output ratios may be fixed when a new product is introduced. These can be reviewed and reconfirmed once every year by Central Excise.*

5. *The import of raw material/inputs by local manufacturers of Electronic Components and assemblies should be routed through a green channel procedure, based on self-certification. Established and regular manufacturers with a good track record should be provided a Green Card for quick processing of their consignments. There should be no need for any Certificate or Bond, and only a consumption report may be required periodically to confirm genuine use of the imported material.*

Source: ELCINA (2015)

Make land available for specialized clusters, delivered in ways that respond to organic firm demand: An important consideration is to get the location right**.** Interviews suggest that manufacturers seeking to link up to global supply chains prefer to locate in areas that are close to ports, to speed up supply chains and reduce dependence on local infrastructure. Setting up clusters in such areas – either as SEZs or industrial parks – that are large enough to house lead firms and suppliers would help attract electronic manufacturers. Investors would also like to see world class infrastructure developed around and within the cluster, especially to link it with the port and to major markets. Another requirement, particularly from SMEs, is for common facilities for R&D and testing facilities, waste dumping, and recycling. Provisions for worker housing within or close to the cluster is important. Manufacturing facilities tend to be located outside urban areas to take advantage of lower land costs. However, ensuring an adequate supply of labor requires them to pay to transport workers to the sites or to create facilities for them to stay close by, both of which raise costs. An inventory of existing Government-owned land that could be made available quickly could be used to allocate parks that are not doing well in their specified purpose for electronic manufacturing. Allowing parcels of land that are close to, though not contiguous, with each other to be classified as a SEZ could deliver benefits of clustering without the difficulties of acquisition. In India, there is a need to remove hurdles and create incentives for states to reclassify and reuse land. In Bangladesh, a good starting point would be for the Government to resolve the 15 year old conflict with the Korean Export Processing Zone, which has led to 2,000 acres of prime industrial land, in a prime location next to the Chittagong port, staying idle.

Make a concerted effort to strengthen both vocational training and curricula for higher-level skill development required for electronics manufacturing: Governments in South Asia should invest more in improving technical and vocational infrastructure (Box 7 shows the example of training in China). Companies can be provided incentives for investing in worker training and R&D. However, introducing major design and managerial reforms into public delivery systems is more critical. This would include, for example, significant involvement of employers in designing curricula and training to ensure greater responsiveness to sector needs. Companies could run "train the trainer" programs for public institutions and help them by offering students live work projects. Another important reform would be to give institutions greater autonomy in deciding training programs, to enable them to respond to changing trends in this fast moving sector. Innovative solutions are needed, for which international experience could serve as a guide.[36]

Box 6: China's approach to providing skills to its workforce

Over the years, the Chinese government has invested extensively in vocational education. The quality of training in Chinese vocational institutions is good, mainly due to extensive industry participation, favorable government policies and a flexible curriculum. The key stakeholders in the ecosystem work hand-in-hand. Chinese courses require students to undergo a full year of training for a diploma, ensuring that students are better equipped to be absorbed immediately into the job market.

Similarly, to make sure that the faculty always keeps abreast of the latest industry practices, the Chinese government has made it compulsory for vocational trainers to spend at least a month every year in manufacturing companies. Additionally, China has made it very easy for vocational students to move back into general academic programs by sufficiently covering general academic skills in vocational curricula.

Chinese firms take employee training, one of the top levers to attract best talent in a competitive market, very seriously. This is reflected in the fact that Chinese manufacturers spend twice the amount on training and development than do their Indian counterparts.

Source: BCG (2013).

Facilitate policy implementation through process changes and institutional innovation: A major issue firms in the region report is the lack of effective dialogue with Government. Policy makers should consider building national monitoring and problem-solving processes and institutions to effectively respond to emerging issues. They could encourage "industrial dialogues" that involve not only large flagship firms, but also young firms that seek to create and commercialize new products and processes, as well as other stakeholders such as university and public R&D labs. These should go beyond being just "talk shops", and should be linked to meaningful, action-oriented committees. One innovation could be to use the large South Asian

[36] World Bank, 2006.

diaspora to mentor and guide policymakers and firms in developing the electronics sector in the region (Box 7).

Box 7: Leveraging the diaspora to build bridges

In the 1960s and 1970s, Taiwan and the United States had a textbook first world-third world relationship. American businesses invested in Taiwan primarily to take advantage of its low-wage manufacturing labor. Meanwhile, Taiwan's best and the brightest engineering students came to the United States for graduate education and chose to stay to pursue professional opportunities. Many ended up in Silicon Valley.

This relationship changed significantly during the 1980s. By the late 1980s, engineers began returning to Taiwan in large numbers, drawn by active government recruitment and the opportunities created by rapid economic development. At the same time, a growing cohort of highly mobile engineers began to work in both the United States and Taiwan, commuting across the Pacific regularly. Typically Taiwan-born, U.S.-educated engineers, these "astronauts" had the professional contacts and language skills to function fluently in both the Silicon Valley and Taiwanese business cultures and to draw on the complementary strengths of the two regional economies A closely knit community of Taiwanese returnees became the bridge between Silicon Valley and Hsinchu. These social ties, which often built on pre-existing alumni relationships among graduates of Taiwan's elite engineering universities, were institutionalized in 1989 with the formation of the Monte Jade Science and Technology Association.

Monte Jade's goal is the promotion of business cooperation, investment, and technology transfer between Chinese engineers in the Bay Area and Taiwan. Although the organization remains private, it works closely with local representatives of the Taiwanese government to encourage mutually beneficial investments and business collaboration. This transnational community has accelerated the upgrading of Taiwan's technological infrastructure by transferring technical know-how and organizational models as well as by forging closer ties with Silicon Valley. Observers note, for example, that management practices in Hsinchu companies are more like those of Silicon Valley than the traditional family-firm model that dominates older industries in Taiwan.

As a result, Taiwan is now the world's largest producer of notebook computers and a range of related PC components including motherboards, monitors, scanners, power supplies, and keyboards. In addition, Taiwan's semiconductor and integrated circuit manufacturing capabilities are now on a par with the leading Japanese and U.S. producers, and its flexible and efficient networks of specialized small and medium-sized enterprises coordinate the diverse components of this sophisticated infrastructure.

Taiwan has also become an important source of capital for Silicon Valley start-ups—particularly those started by immigrant entrepreneurs who historically lacked contacts in the mainstream venture capital community. Formal investments from Asia (not including Japan) were more than $500 million in 1997. These investors often provide more than capital. According to Ken Tai, a founder of Acer and now head of venture fund, InveStar

Capital:"When we invest we are also helping bring entrepreneurs back to Taiwan. It is relationship building . . . we help them get high level introductions to foundries (for manufacturing) and we help establish strategic opportunities and relationships with customers."

The growing integration of the technological communities of Silicon Valley and Hsinchu offers substantial benefits to both economies. Silicon Valley remains the center of new product definition and design and development of leading-edge technologies, whereas Taiwan offers world-class manufacturing, flexible development and integration, and access to key customers and markets in China and Southeast Asia

Source: Saxenian (1999)

References

Altenburg, Tilman, Meyer-Stamer, JÖRG. 1999. "How to promote clusters: policy experiences from Latin America, World Development", Vol 27 Issue 9

Ark B.V., A. A. Erumban, V. Chen and U. Kumar (2008). "The Cost Competitiveness of Manufacturing in China and India: An Industry and Regional Perspective." Working Paper 228, ICRIER, New Delhi

BCG (2013). "People Productivity. Key to Indian Manufacturing competitiveness." Boston Consulting Group, March 2013. Available at http://www.bcgindia.com/documents/file130179.pdf

Bozz & Company (2008). "Global Innovation 1000" in Bampi, S. (Coord.). Projeto PIB: Perspectivas do Investimento em Eletronica. Rio de Janeiro: UFRJ. Available at http://www.ie.ufrj.br/projetopib/arquivos/ie_ufrj_sp08_eletronica.pdf

Choudhary, S., M. Kallumal, and P. Varma. (2013). "Trade Creation and Trae Diversion in the India Sri Lanka FTA- A Sectoral Specific Analysis." Working Paper, Center for WTO Studies, IIFT Delhi.

Colecchia, A., & Schreyer, P. (2002). "ICT investment and economic growth in the 1990s: is the United States a unique case?: a comparative study of nine OECD countries." Review of Economic Dynamics, 5(2), 408-442.

Crespi, G. and Zuninga P., (2012). "Innovation and Productivity: Evidence from Six Latin American Countries." World Development, 40(2), 273-290.

D&B Analysis. "IT Hardware & Electronics: Productivity & Efficiency Benchmarking." http://www.dsir.gov.in/reports/isr1/IT%20Hardware%20and%20Electronics/4_9.pdf

Ernst, Dieter, 2014. "Fast Tracking India's Electronics Manufacturing Industry: Business environment and industrial policy." World Bank.

Goldar, Bishwanath and A. Sadhukhan. 2015. Employment and wages in Indian manufacturing: Post-reform performance. ILO Employment Working Paper No. 185

Griffith, R., Huergo, E., Mairesse, J., and Peters, B., (2006). "Innovation and productivity across four European countries." Oxford Review of Economic Policy, 22(4), pp.483-498.

Hall, B.H., Lotti, F., and Mairesse, J., (2009). "Innovation and productivity in SMEs: Empirical evidence for Italy." Small Business Economics, 33(1), pp.13-33.

Hall, B. H. and Mohnen, P., (2013). "Innovation and productivity: an update." Eurasian Business Review, 3(1), 47-65.

Hoda, A. and D. K. Rai (2014). "Trade and Investment Barriers affecting International Production Networks in India." Working paper 281, ICRIER, New Delhi

ILO, 2014 (A). "Better Work: Electronics feasibility Study" Available at http://betterwork.com/global/wp-conten/uploads/Better-work-Electronics-Feasibility-Study-Executive-Summary.pdf

ILO, 2014 (B). "Ups and Downs in the Electronics industry: Fluctuating Production and the use of temporary and other forms of employment." ILO, Geneva

India Printed Circuit Board Association (2008). Presentation of Dr. Hayao Nakahara (N.T. Information Ltd, Japan) at November 2008, http://www.ipcaindia.org/pdffiles/PCBMktOppDrNakahara.pdf

J Manyika et al, 2012. "Manufacturing the future: The next era of global growth and innovation", McKinsey Global Institute, November 2012

Jordan L.S. and B. Kamphuis (2014). "Supply Chain Delays and Uncertainty in India: The hidden constraint on manufacturing growth." World Bank, New Delhi, March 2014

Korea Associates Business Consultancy Ltd (2012). "Global Value Chain Analysis on Samsung Electronics." Reported submitted to the Commercial Section of the Canadian Embassy in the Republic of Korea.

Lima, R. R. S. (2012) "Complexo Eletronico: Evolucao Recente e os Desafios para o Setor e para a Atuacao do BNDES" in: Lage de Sousa (Org.). 'BNDES 60 Anos: Perspectivas Setoriais' Limited Edition, Vol. I, pages 42-96, BNDES, Rio de Janeiro, Brazil. Available at http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Galerias/Arquivos/conhecimento/livro60anos_perspectivas_setoriais/Setorial60anos_VOL1ComplexoEletronico.pdf

Musolesi, A. and Huiban, J.P., (2010). "Innovation and productivity in knowledge intensive business services." Journal of Productivity Analysis, 34(1), pp.63-81. Organization for Economic Co-operation and Development (OECD), 2005. Oslo Manual, 3rd ed. Paris: OECD.

National Productivity Council. "Productivity and Competitiveness of Indian Manufacturing: IT Hardware and Electronics." Submitted to the National Manufacturing Competitiveness Council

OCDE (2010) Information Technology Outlook 2010. Figures 2.22 (page 87) and 2.23 (page 88). Available at http://www.oecd-ilibrary.org/docserver/download/9310021e.pdf?expires=1455045589&id=id&accname=ocid195787&checksum=BA0C9BBED864FF2D7CC35A068A2D6365

Oliver Wyman (2007) "A comprehensive study on innovation in the automotive industry" apud Lima (2012) "Complexo Eletronico: Evolucao Recente e os Desafios para o Setor e para a Atuacao do BNDES"

Poh-Kam, Wong. 1995. "Competing in the global electronics industry: A comparative study of the innovation networks of Singapore and Taiwan" Journal of Industry Studies , Volume 2, Issue 2, 1995

Saleman, Y and L. S. Jordan (2013). "The Implementation of Industrial Parks: Some Lessons Learned in India.' World Bank, 2013

Saxenian, AnnaLee (1999). "Silicon Valley's New Immigrant Entrepreneurs." Public Policy Institute of California, Palo Alto 1999.

Sincavage, Jessica R., Carl Haub, and O.P. Sharma. 2010. Labor costs in India's organized manufacturing sector. Monthly Labor Review, May 2010

Sturgeon, Timothy (2015). "Vietnam's Current and Future Role in Information and Communications Technology (ICT) Global Value Chains (GVCs)". Mimeo, World Bank & IFC

Subramanian, Arvind and A. Modi. 2015. "'Make in India' not by protecting but by eliminating negative protectionism" Business Standard http://www.business-standard.com/article/opinion/make-in-india-not-by-protecting-but-by-eliminating-negative-protectionism-115050100026_1.html

UNCTAD (2013). World Investment Report 2013: Global Value Chains- Investment and Trade for Development. United Nations, New York and Geneva 2013

ValueOnShore (2015). "Medical Devices Sector in India," mimeo, ValueOnShore Advisory Services. May 2015

Weerakoon D. and J. Thennakoon. "India Sri Lanka FTA; Lessons for SAFTA"Institute for Policy Studies, Sri Lanka.

World Bank (2005). "Linkages between Foreign Direct Investment and Trade Flows. From Disintegration to Reintegration: Eastern Europe and the Former Soviet Union in International Trade." Washington DC 2005. Available at http://siteresources.worldbank.org/INTECA/Resources/tradereport-complete.pdf (accessed November 5 2013).

Wu, H. X., B. L. Lee, and D.S. Prasada Rao (2007). "COMPARATIVE PERFORMANCE OF INDIAN AND CHINESE MANUFACTURING INDUSTRIES, 1980-2004." Presented at the Special Conference of the International Association for Research in Income and Wealth (IARIW) on Transition Economies, 18-21 Beijing, People's Republic of China.

Technical Annexes

Annex 1

Trends in Registered Manufacturing of Electronics and IT Hardware Industry in India

Characteristics	1990- 91	2000-01	2001- 02	2003-04	2004-05	2005-06	CAGR		
							Total Period (1990-91 to 2005-06)	Period I (1990-91 to 2000-01)	Period II (2000-01 to 2005-06)
Number of Factories	1591	1583	1432	1314	1371	1359	-1.05	-0.05	-3.01
Number of Workers	96770	97270	87274	85540	91416	103129	0.43	0.05	1.18
Total Persons Engaged	158991	151130	135387	132941	138300	151102	-0.34	-0.51	0.01

Source: National Productivity Council

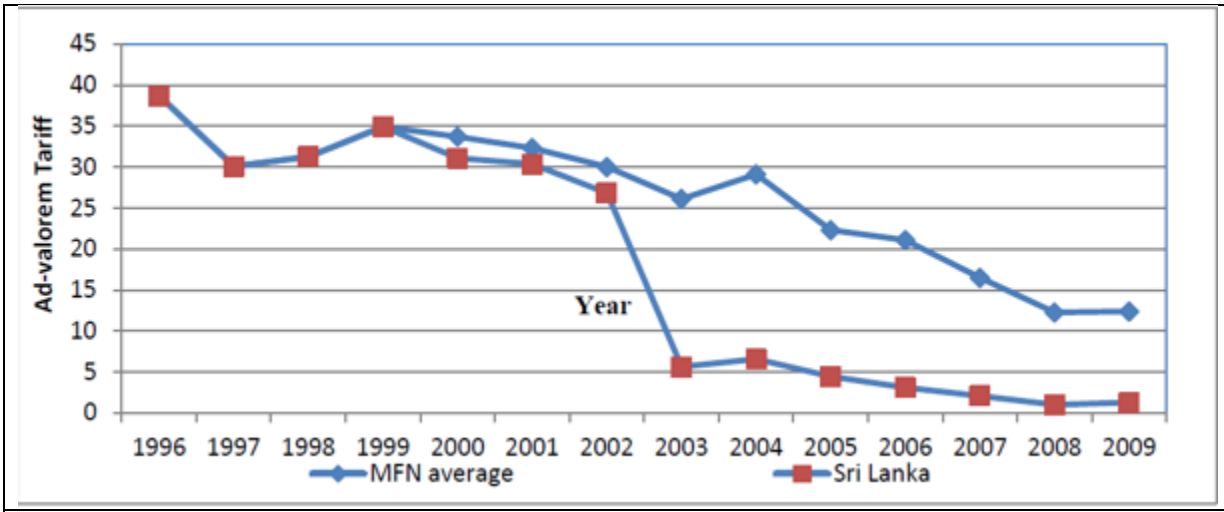
Annex 2

Schedule of Tariff concessions under India Sri Lanka FTA

Granting Country	Tariff Cuts	Items description
Sri Lanka	0 per cent removal of tariff	for items in Annexure D of the agreement . Around 1180 items were there in negative list(annexure D)
	100 per cent removal of tariff	for items in Annexure F-1 of the agreement . Total number of items under this category 319
	50 per cent removal of tariff followed by phased out removal of tariff	for items in Annexure F-II of the agreement (the margin will be deepened to 70 per cent, 90 per cent and 100 per cent respectively at the end of first, second and third year of the entry into force of the agreement). Total number of items under this category 889.
	Residual List	for remaining items by not less than 35 per cent before the expiry of three years. 70 per cent before the expiry of sixth year and 100 per cent before the expiry of eighth year. Total number of items under this category 2724.
India	0 per cent removal of tariff	for items in Annexure D of the agreement (Negative List) . Total number of items under this category -429
	25 per cent removal of tariff	for items in Chapters 51-56, 58-60, 63. Total number of items under this category-233
	100 per cent removal of tariff	for items in Annexure E of the agreement .Total number of items under this category-1351
	50 per cent removal of tariff	Up to 15Mn. Kgs. Of Tea, 2 Mn. pieces of garments, and 6 Mn. pieces of garments using Indian fabrics. On utilization of unrestricted quota, an additional quota of 2 million pieces out of 8 Mn. pieces is permitted .
	50 per cent removal of tariff followed by phased out removal of tariff	for remaining items (margin will be increased upto 100 per cent in two stages within three years. .Total number of items under this category-2799

Annex 3

India's Average Applied MFN and Preferential Tarff under India Sri Lanka FTA



Source: Choudhary et al (2013)

Annex 4: Duty Inversions impacting the Electronics Sector in India

FINAL PRODUCT							RAW MATERIAL						
Sl. No.	HS Code	Product Description	Current Basic Custom Duty	Current SAD (Special Additional Duty)	Current CVD (Counter Veiling Duty)	Is the final product imported under an FTA in India at concessional duty?	Sl. No.	HS Code	Product Description	Current Basic Custom Duty	Current SAD	Current CVD	Is the raw material imported under an FTA in India at concessional duty?
A	84182100	Refrigerator	10%	0%	12.5%, 35% rebate when importing on MRP	Thailand, Veitnam, Indonesia Philippines, Singapore,	1. Compressor	8414.30 00	Compressor	7.5%	4%	12.5%	NA
							2. Roll Bond Panel	8418.99 00	Roll Bond Panel	7.5%	4%	12.5%	NA
							3. Isocynate	2929.10 90	Isocynate	10%	4%	12.5%	Japan
							4. Cyclopentane	2902.19.00	Cyclopentane	10%	4%	12.5%	NA
							5. Glass	70071900	Glass	10%	4%	12.5%	NA
							6. Fan Motor	85013210	Motor	7.5%	4%	12.5%	NA
							7. CFM	7210.70 00	CFM	7.5%	4%	12.5%	Korea
							8. Timer	90292090	Timer	10%	4%	12.5%	NA
B	84501100	Washing Machine	10%	0%	12.5%, 35%	Thailand, Vietnam,	1. Motor	85013119	Motor	10%	4%	12.5%	NA
							2. Drive	84834000	Drive	10%	4%	12.5%	
A	84182100	Refrigerator	10%	0%	12.5%, 35% rebate when importing on MRP	Thailand, Veitnam, Indonesia Philippines, Singapore,	1. Compressor	8414.30 00	Compressor	7.5%	4%	12.5%	NA
							2. Roll Bond Panel	8418.99 00	Roll Bond Panel	7.5%	4%	12.5%	NA
							3. Isocynate	2929.10 90	Isocynate	10%	4%	12.5%	Japan
							4. Cyclopentane	2902.19.00	Cyclopentane	10%	4%	12.5%	NA
							5. Glass	70071900	Glass	10%	4%	12.5%	NA
							6. Fan Motor	85013210	Motor	7.5%	4%	12.5%	NA
							7. CFM	7210.70 00	CFM	7.5%	4%	12.5%	Korea
							8. Timer	90292090	Timer	10%	4%	12.5%	NA
B	84501100	Washing Machine	10%	0%	12.5%, 35%	Thailand, Vietnam,	1. Motor	85013119	Motor	10%	4%	12.5%	NA
							2. Drive	84834000	Drive	10%	4%	12.5%	

Source: FICCI

Annex 5: Key Incentives Offered in SEZs for Electronic Manufacturing

	Fiscal Incentives	Logistics	Other Features
Sri Lanka	**Duty free** imports of capital goods and raw materials	Processing of import/export documents, on-site examination of cargo	Subcontracting for urgent production orders between SEZ companies
	Exemption from VAT and Ports and Airports Development Levy (PAL)	Temporary export of captial goods for repair	Total foreign ownership permitted
	Exchange control exemption	Non-export oriented companies are entitled to import project related capital goods free of Customs Duty, during the project implementation period	
Bangladesh	**Duty Free** imports of machinery and raw materials, construction materials and 3 motor vehicles; duty free exports	Export and import permits issued same day; customs clearance at plant	100% foreign equity allowed; full repatriation in case of exit
	Tax holiday for 10 years, concessionary tax for 5 years after; exemption reduced throughout 10 years: 1st and 2nd year 100%, 3rd year 80%, 4th 70%, 5th 60%,6th 50%, 7th 40%, 8th 30%, 9th 20% and 10th year 10%		No restrictions on issuance of work permits on project related foreign nationals and employees but limited up to 5% of total employees; 50% Rebate of income tax on salary income of expatriates for 5 years
	80% exemption of VAT on all utility services consumed inside the zone; 50% exemption of stamp duty and registration fees	Option to relocate from one EPZ to another	

	for registration of leasehold land/ factory space; Exemption from dividend tax for 3 years, exemption from capital gains tax	SEZ is considered a customs bonded area	Secure land and factories for rent; electricity, telecommunications, gas and water facilities
Vietnam	**Tax holiday** for four years. Then corporate income tax increases to 5% for years 5-13 and then to 10% from years 13-15. Rate then reaches country-wide tax rate of 22% (will be lowered to 20% in January 2016). Rate stays at 10% for 30 years if the project is large and involves a new technology in an incentivized sector (ICT)	On site electronic customs clearance	Companies pay reduced tax (10%) on income from corporate **workforce training** for the lifetime of the project
	Duty free import of equipment and machinery, transport vehicles for workers including 24 or more seat motor vehicles and boats, components and spares for both categories of goods, components, raw materials, and construction materials that cannot be produced domestically. Also import duty and VAT exemption on goods used in scientific research and technological development	**One stop shop**: approval of work permits (for foreigners), construction permits, environmental assessments, and investment certificates	**Subsidized training** for hired and pre-hired employees. Programs include soft skills, technical English, technical skills as well as on-demand training
			Access to preferential loans (up to 70% of the project's total investment) and grants (up to 30% of the project's total investment)
	Export duty and VAT exemption on high technology products (full list in tab titled "Vietnam High Tech Products")		Companies can set aside 10% of annual taxable income for R&D

India	**Duty free import** of required machinery, production lines and related equipment; import and domestic procurement of component parts as required for the final product	On-site customs clearance, post and telegraph office, satellite data link facility required for software exports	The minimum area requirements for multi-product SEZs is now reduced from 1000 hectares to 500 hectares, or from 100 hectares to 50 hectares for sector-specific SEZs and SEZs with one or more services
	VAT rebate of 100% on exported India sourced components		Minimum area requirement of 10 hectares for SEZs proposed to be set up exclusively for electronic hardware and software
	Corporate Income Tax exemption on export income for first 5 years, 50% for next 5 years thereafter and 50% of the ploughed back export profit for next 5 years	**Noida SEZ Logistics:** NSEZ has been declared as an Inland Container Depot (ICD) under the Customs Act, 1962 to facilitate inward/outward movement of cargo	Unit may now opt out of a SEZ by transferring its assets & liabilities to another person by way of transfer of ownership, including a sale of the SEZ Unit.
	Exemption from Service Tax, Minimum Alternate Tax, Central Sales Tax, State Sales Tax and other levies as extended by the respective State Governments	**Madras SEZ Logistics:** SEZ firms can file their bills of entry from their factory. The Preventive Wing of the SEZ's customs division has 11 staff members, 24/7 to process goods entering the zone from abroad or elsewhere in the country	**Single window** clearance for Central and State level approvals
	Subsidy of 20% for capital expenditures		**External commercial borrowing** by SEZ units up to US $ 500 million in a year without any maturity restriction through recognized banking channels

(Foreign Invested Companies)	**Corporate income tax** exemption for first two years of operation. Foreign-owned firms pay half of corporate tax rate for ensuing three years (15%). Tax rate is 10% for certified firms that export at least 70% of production. Potential additional three-year extension at 10%. Rate eventually rises to normal tax rate of 25% (Including national and state taxes). High-tech enterprises that invested in or after 2008 can also apply for a two-year tax holiday followed by three years of a 12.5 percent rate	Transportation service provided from a Chinese company to a foreign company is subject to 0% VAT; VAT for international logistics can be exempted. However, each company has to apply at the tax bureau for VAT exemption	Foreign invested companies must apply for foreign exchange registration with SAFE. These companies can take on foreign debt without SAFE's approval. However, the total amount of foreign debt cannot exceed the difference between registered capital and total investment amount
	Land use fee will be cut in half for five years for certified exporters that import state-of-the-art technology		
China	**Integrated circuit production** companies receive a five-year corporate income tax holiday, followed by five years at 50% the normal rate (25%) when slated for at least 15 years of operation, and when total investment exceeds RMB 8 billion or where produced ICs have a width of less than 0.25µm		Foreign invested companies can repatriated profits once taxes have been paid in full, dividends have been declared, and losses from previous years of operation have been made up
	If **R&D expenditures** increase by 10% from the previous year, companies are eligible for 50% corporate income tax deduction		

Source: Staff, based on publicly available information

Annex 6: Data and analysis of innovation and obstacles to productivity

Table 1: Innovation Expenditures by Electronic firms in South Asia

Size	No. of Electronic Firms	% of Firms with Innov. Exp.	Innovation Expenditure per Sales
SMEs (<100)	202	67.3%	4.7%
Large (>=100)	99	73.7%	1.1%
Total	301	69.4%	3.5%

Table 2: Avg. of Expenditures and New Products over Sales for Electronics in South Asia

Size	Machinery	Non-Machinery	Total	New Products
SMEs (<100)	3.9%	0.9%	4.7%	6.1%
Large (>=100)	0.4%	0.7%	1.1%	10.3%
Total	2.7%	0.8%	3.5%	7.5%

Table 3: Obstacles to Productivity - Electronics

	(1)	(2)	(3)
VARIABLES	Labor Prod - All4	TFP - All4	Prod Growth - All4
Finance	-0.0146	-0.0066	-0.0105
	(0.015)	(0.015)	(0.009)
Political	0.0334	-0.0710	0.0146*
	(0.061)	(0.027)	(0.004)
Crime	0.0583	-0.0446	0.0208*
	(0.258)	(0.039)	(0.007)
Taxes	-0.0463	0.0938*	0.0053
	(0.234)	(0.022)	(0.007)
Corruption	-0.0193	0.0188	0.0116
	(0.022)	(0.024)	(0.007)
Informal Sector	-0.0598	0.0760	0.0262
	(0.142)	(0.034)	(0.020)
Labor Regulations	-0.0569	-0.1465***	-0.0402
	(0.111)	(0.009)	(0.018)
Workforce Education	0.0299	-0.0545	-0.0054
	(0.094)	(0.022)	(0.009)
Electricity	-0.0901	-0.0259	0.0080
	(0.031)	(0.039)	(0.011)
Constant	9.7807***	1.0413	-0.1110
Observations	609	422	521
R-squared	0.0598	0.0915	0.0716

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: CDM Model solved sequentially for Electronics in South Asia

	(1)	(2)	(3)
Stage	1st Stage	2nd Stage	3rd Stage
Dependent Variable	Log(Innov. Expenditures/Sales)	Log(New Products/Sales)	Log(Labor Productivity)
Predicted Log(Expenditure/Sales)		22.2136*	
		(11.530)	
Predicted Log(New Products/Sales)			2.5828**
			(1.204)
Log(Size)	-0.0136***	0.3094**	0.1238
	(0.005)	(0.154)	(0.120)
Log(Age)	0.0136*	-0.3412**	
	(0.007)	(0.163)	
Export	0.0053	0.0182	
	(0.012)	(0.094)	
Foreign Status	-0.5074	8.9797	
	(0.000)	(0.000)	
Internal Funds	-0.0103	0.2042	
	(0.012)	(0.153)	
Duopoly / Monopoly	0.0080		
	(0.014)		
Capital Labor Ratio			0.0000
			(0.000)
Process Innovation			0.3063
			(0.274)
Organization Innovation			0.1889
			(0.203)
Constant	-0.0192	0.1755	10.0211***
	(0.046)	(0.356)	(0.892)
Observations	290	295	155
R-squared			0.1243

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The analysis of the drivers of productivity based on the World Bank Enterprise Surveys confirms that size and export status are positively associated with productivity in this sector across Bangladesh, India, Pakistan and Sri Lanka (see Table 5 below).

Table 5: Drivers of Productivity - Electronics

VARIABLES	(1) Labor Prod - All4	(2) TFP - All4	(3) Prod Growth - All4
Log(Size)	0.2155***	0.0660	0.0130
	(0.011)	(0.024)	(0.015)
Log(Age)	-0.1457	-0.0967	-0.0148
	(0.130)	(0.064)	(0.018)
Foreign	-0.3572	0.1694	-0.0375
	(0.544)	(0.428)	(0.201)
Exporter	0.2684	0.3433*	-0.0583***
Constant	9.7807***	1.0413	-0.1110
	(0.496)	(0.395)	(0.078)
Observations	609	422	521
R-squared	0.0598	0.0915	0.0716

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1